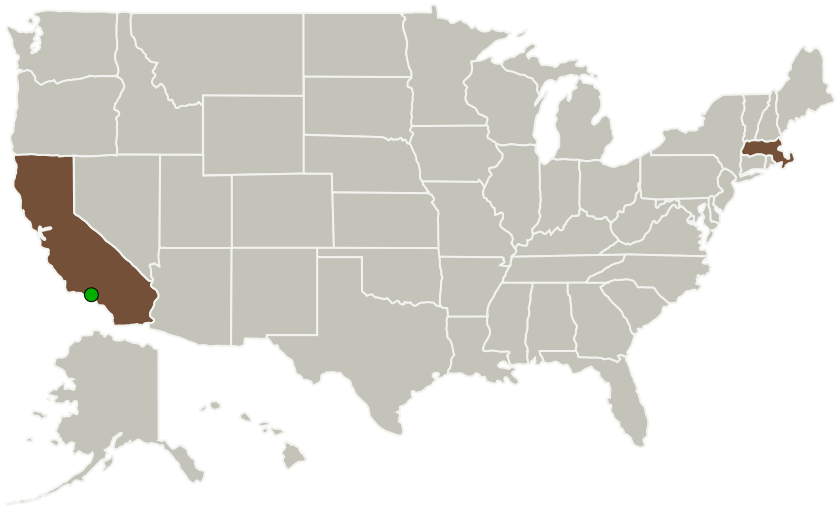
Ultra Compact Laser for 3D Imaging LIDAR, Phase I

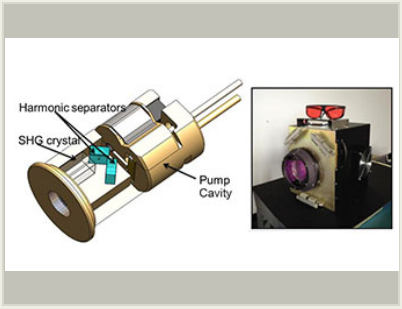
Completed Technology Project (2016 - 2016)

Project Introduction

Missions to Solar System bodies must meet increasingly ambitious objectives requiring highly reliable capabilities in ranging and mapping for soft and precision landing to avoid hazardous sites. A compact and light weight LiDAR instrument is needed for topography mapping, position sensing, laser altimetry, and autonomous rendezvous of satellites. Missions to small bodies such as asteroids, comets, and moons require precision rendezvous and accurate identification of landing or sampling sites. Precision range data significantly improves spacecraft control in close-approach and landing scenarios. Range data is most critical in the final descent phase where the spacecraft is within a few kilometers of the target surface. These missions require improved precision from previously flown lidar technologies as well as significant reductions in size, weight, and power (SWaP) given the resource-constrained class of missions likely to utilize this capability. Q-Peak, in partnership with Sigma Space Corp., is proposing a low-SWaP laser integrated into a compact laser LiDAR instrument that can achieve the desired ranging accuracy and precision with minimum resource from spacecraft bus. In Phase I, Q-Peak proposes the development of an ultra-compact, passively Q-switched laser, < 4 cm3 in volume that will produce > 0.1 mJ pulse energies and < 2 ns-duration pulses at 523 nm at pulse repetition rates of 10-30 kHz. This laser will be specifically designed for integration and testing in the newly developed LiDAR instrument at Sigma Space. In Phase II, Q-Peak will bond the passive Q-switch to the laser gain medium to make it monolithic and essentially alignment free. We will harden the laser and integrate it into the LiDAR instrument to advance the TRL level by subjecting them to a space-like environment.

Primary U.S. Work Locations and Key Partners





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Organizations Performing Work	Role	Type	Location
Q-Peak, Inc.	Lead Organization	Industry	Bedford, Massachusetts
Jet Propulsion Laboratory(JPL)	Supporting Organization	NASA Center	Pasadena, California

Primary U.S. Work Locations	
California	Massachusetts

Project Transitions

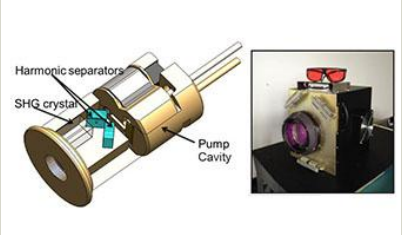
June 2016: Project Start

December 2016: Closed out

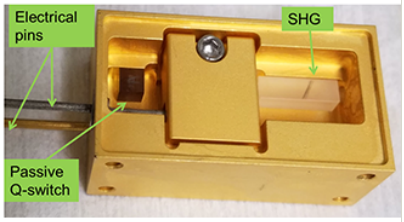
Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/141059)*

Images



Briefing Chart Image
Ultra compact laser for 3D imaging LIDAR, Phase I
(https://techport.nasa.gov/image/134886)



Final Summary Chart Image
Ultra compact laser for 3D imaging LIDAR, Phase I Project Image
(https://techport.nasa.gov/image/135507)

Organizational Responsibility

Responsible Mission Directorate:
Space Technology Mission Directorate (STMD)

Lead Organization:
Q-Peak, Inc.

Responsible Program:
Small Business Innovation Research/Small Business Tech Transfer

Project Management

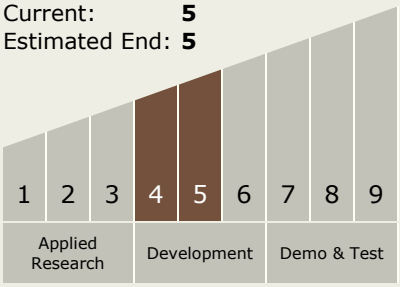
Program Director:
Jason L Kessler

Program Manager:
Carlos Torrez

Principal Investigator:
Bhabana Pati

Technology Maturity (TRL)

Start: **4**
Current: **5**
Estimated End: **5**



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Completed Technology Project (2016 - 2016)

Technology Areas

Primary:

- TX09 Entry, Descent, and Landing
  - TX09.4 Vehicle Systems
    - TX09.4.7 Guidance, Navigation and Control (GN&C) for EDL

Target Destinations

The Moon, Mars, Outside the Solar System, The Sun, Earth, Others Inside the Solar System